PATENT SPECIFICATION (11) 1275651

1275651

DRAWINGS ATTACHED

(21) Application No. 9238/69 (22) Filed 20 Feb. 1969

(23) Complete Specification filed 12 Feb. 1970

(45) Complete Specification published 24 May 1972

(51) International Classification B01D 27/08

(52) Index at acceptance B1D 1A 1G 1U 2J1B2 2J1C3 2J1D

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(54) LIQUID FILTER ASSEMBLIES

(71) We, GENERAL MOTORS LIMITED, a British Company, of 23, Buckingham Gate, London, S.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to liquid filter assemblies and in particular to discardable or so-called "throw-away" liquid filter assemblies which are used in internal combustion engine lubrication systems and in which a filter element is retained within a metal canister of relatively thin sheet metal which is closed at one end by a plate of thicker gauge metal formed with an inwardly directed neck, which is internally threaded to form a socket which is adapted to be screwed on to a complementary threaded spigot which projects from an oil passage in a mount face of an engine block on to which the filter is to be fitted. The end plate also has therein around the threaded socket additional openings which communicate with one or more oil passage openings in the mount face when the filter assembly is screwed on to the spigot so as to bring a peripheral gasket on the assembly into sealing engagement with a seat on the mount face, the opposite sides of the filter element thereby being placed in communication with the inlet and outlet passages of the engine lubrication system. Customarily, the spigot is adapted to receive filtered liquid after it has passed through the filter element from the outside to the inside thereof, but the assembly may be arranged so that filtration takes place in the opposite direction through the filter element.

According to the invention, in such a filter assembly means are provided in association with the threaded socket to form a substantially fluid tight seal between the threaded portions of the spigot and socket.

In a preferred embodiment of the invention the neck in which the thread of the socket is formed has fitted thereon an annular gasket or seal member of elastomeric material formed with an annular tongue of wedge section the thin edge of which projects radially inwards slightly beyond the threads so that, when the socket is screwed on to the spigot, the annular tongue engages and forms a seal with the threads of the spigot. The annular tongue may have an axial slit formed therein to allow the whole of the tongue to fill one turn of the thread on the spigot.

The gasket with the integral tongue is conveniently formed integral with a radially projecting flange which overlies the openings in the end plate of the assembly around the threaded socket and constitutes a non-return valve which permits the entry of oil to be filtered into the casing but prevents the flow of oil from said openings when the filter element is removed therefrom, or when the lubrication system is no longer in operation to circulate lubricant through the filter assembly.

The invention overcomes a difficulty which frequently arises with the use of discardable oil filter elements of the kind known hitherto, in which leaks between the interengaged threads of the spigot and socket connection may permit the passage of unfiltered liquid into the oil circulation system, with the danger of damage to the working parts of the engine. The leaks arise from the necessity of allowing sufficient tolerance between the threaded parts to accommodate the degree of non-coaxiality between the filter casing, end plate and socket which may occur in large scale manufacture of the parts of the filter assembly.

The scope of the invention is defined by the appended claims; and the invention and the method by which it is to be performed are hereinafter particularly described with reference to to the accompanying drawings, in which:—

Figure 1 is a vertical section of a preferred embodiment of a filter unit according to the invention and of a mount face on an internal combustion engine on which the filter unit is to be mounted;

Figure 2 is a plan of the filter unit shown in Figure 1;

Figure 3 is a detail section in which the spigot and socket shown in Figure 1 are interengaged; and

Figure 4 is an enlarged view of the elastomeric seal member shown in Figure 1.

Figure 1 of the drawings shows an oil filter unit 1 which is adapted to be secured on an internal combustion engine mount face 2 by being screwed on to a threaded oil inlet spigot 3 which projects from the mount face 2 and is surrounded by an annular recess 4 which is in communication with an oil outlet passage 5 of the engine lubrication system.

The filter unit 1 comprises a thin sheet metal casing 6 within which is housed a filter element 7 of pleated synthetic resin-impregnated filter paper, the pleats extending longitudinally of the element 7 so that the element is of star-form in section and the ends of the pleats being individually sealed separately from adjacent pleats. The pleats are formed with spacer dimples 8 and ribs 9 impressed therein so as to space each pleat from adjacent pleats and to space the two halves of each pleat from each other to permit a ready flow of filtered liquid therethrough. The construction of the filter element per se may be other than that described and illustrated.

The filter casing 6 is a cup-shaped pressing of relatively thin sheet metal, the open end of the casing being closed by a thicker annular end plate 10 having a central threaded outlet opening 11 therein, the periphery of the plate 10 having secured thereto, as by welding, an annulus of thin sheet metal 12 which is secured by a lockseam joint 14 to the end of the cup-shaped pressing 6. The sheet metal annulus 12 is formed so as to have a rectangular U-shaped section in which an annular gasket 15 of elastomeric material is retained adjacent the periphery of the end plate 10 to form a seal with the mount face 2 when the filter unit 1 is screwed on to the threaded spigot 3. The end plate 10 has therein a plurality of inlet openings 16 around the central outlet opening 11, the latter being formed in an internally extending co-axial socket or neck 17 formed on the end plate 10.

Extending around the neck 17 on the end plate 10 is an annular seal member 20 (which also acts as a relief valve) of synthetic rubber or plastics material, formed as an annular disc with an integral outwardly extending resilient flange 21 which normally overlies and seals the inlet openings 16 in the end plate 10 and acts as a non-return valve. The disc 20 has an inner peripheral portion 22 which forms a sliding seal with the neck 17 of the end plate 10; and intermediate the inner peripheral portion 22 and the flange 21 the disc has a face 23 which abuts the inner surface of the end plate 10. The seal member 20 has a neck 24 which extends coaxially from the central portion thereof from the side opposite the face 23, the neck 24 constituting the movable member of a relief valve, the fixed seat for which is formed by an internal annular portion of a support tube 30, one end of which extends within one end of the filter element 7. If the pressure drop across element 7 rises sufficiently, the neck 24 deforms inwardly from its seat to by-pass the oil.

The neck tube 24 has, intermediate its ends, an integral annular tongue 25 of wedge section, the thin edge of the tongue 25 projecting radially inwards slightly beyond the threads of the neck or socket 17 so that, as shown in Figure 3, when the neck 17 is screwed on to the spigot 3, the annular tongue 25 engages and forms a seal with the threads of the spigot. The annular tongue 25 may have an axial slit 26 formed therein, as shown in Figure 4, to allow the whole of the tongue to fill one turn of the thread on the spigot 3.

The support tube 30 (Figure 1) is preferably made of plastics material and is of generally tubular form and of a size to be a press fit within the annular filter element 7. The end of the support tube which extends within the element is formed with an integral end wall 31 having perforations 32 therein and a central dependent stud 33. At its other end the support tube is formed with castellations 34 which engage in an annular recessed portion 35 of the seal member 20 around the neck 24 thereof.

The portion of the support tube 30 which fits within the filter element 7 is formed with a plurality of longitudinal grooves (not shown) which intersect circumferential grooves 36, therein so as to permit filtered oil to pass longitudinally in the spaces thereby provided between the support tube 30 and the inner periphery of the filter element 7.

The support tube 30 also has an external radial flange 38 extending therefrom, the flange 38 being adapted to abut one end of the filter element 7 adjacent the inner periphery thereof and form a seal flange therewith. The surface of the external flange 38 facing the end plate 10 is formed with a plurality of protrusions 39 thereon spaced about its periphery so that if the peripheral flange 21 on the seal member 20 is deflected inwardly towards the external flange 38 on the support tube 30 the spaces between the protrusions 39 and the flange 21 will permit fluid flow from the exterior of the filter element 7 to the castellated axially extending portion of the support tube 30.

The central opening at the other end of the filter element 7 adjacent the base of the filter casing 6 is closed by an end cap 40 with a central recessed portion 42 which fits within said opening, the cap being pressed resiliently into sealing contact with said other end of the filter element 7 by integral resilient arms 41 on the end cap; alternatively a helical spring could be used, one end thereof bearing against the central recessed portion 42 of the end cap 40, and the other end of the spring abutting the base of the cup-shaped filter casing 6.

The recessed portion 42 of the end cap 40 has therein a central aperture into which the

dependent stud 33 at the base of the support tube 30 is press-fitted so as to retain the end cap and the flange 38 on the support tube 30 in sealing contact with opposite ends of the filter element 7. Alternatively the end cap 40 could be formed with an axially extending stud which could be press-fitted into a complementary opening in the end wall 31 of the support tube 30.

In the use of the filter unit 1 the pressure of the oil entering by way of the inlet openings 16 in the end plate 10 deflects the peripheral flange 21 on the seal member 20, the oil then flowing through the filter element 7 and passing by way of the longitudinal and circumferential grooves on the support tube 30 to the openings 32 in the end wall thereof and thence through the central passage in the support tube to the central outlet opening 11 in the end plate 10. When there is no pressure of oil from the oil outlet passage 5 the flange 21 seats on the end plate 10 and prevents oil on the inlet side of the filter element 7 from draining back into the passage 5.

The provision of the annular tongue 25 on the seal member 20 ensures that, when the filter unit is screwed on to the spigot 3 so as to bring the gasket 25 into engagement with the seat face 2 the leakage of oil between the interengaged threads of the spigot 3 and the neck or socket 17 is prevented by the engagement of the tongue 25 in the threads of the socket 3. As the tongue 25 projects radially inwards slightly beyond the threads of the neck 17 the tongue is slightly compressed when it engages in the threads of the socket 3 and thereby ensures that the latter are effectively sealed. If, as shown in Figure 4 the tongue 25 is formed with an axial slit 26 the tongue will fit completely into and seal one complete turn of the thread of the threaded end of the spigot 3.

The tolerance which normally has to be allowed between the threaded spigot 3 and socket 17 in order to accommodate the degree of non-coaxiality between the filter casing 6, the end plate 10 and the neck 17, which inevitably occurs in large scale manufacture of the parts of the filter unit, has the inevitable result that in many cases the fit between the threads on the spigot and the socket is insufficient to prevent the leakage of the oil to be filtered (which is under pressure) along the interengaged threads so that, despite the provision of an effective filter element harmful solid particles might thereby pass into the oil circulation system and damage the working parts of the engine. The construction according to the invention prevents such leakage without requiring expensive parts or the use of higher (and more expensive degrees of precision in the manufacture of the parts of the filter unit.

WHAT WE CLAIM IS:—

1. A filter unit in which a filter element is retained within a casing having an end plate with an inwardly directed neck threaded to form a socket adapted to be screwed on to a tubular threaded spigot on a mount face so that the filter element is interposed in a liquid flow path by way of the interconnected spigot and socket and additional openings in said end plate around the socket and one or more openings in said mount face, said neck having fitted thereon an annular gasket of elastomeric material formed with an annular tongue of wedge section the thin edge of which projects radially inwards slightly beyond the threads in the neck so that, when the socket is screwed on to the spigot the annular tongue engages and forms a seal with the threads of the spigot.

2. A filter unit according to claim 1, in which said gasket is formed integral with a radially projecting flange which overlies said additional openings in the end plate and constitutes a non-return valve.

3. A filter unit, substantially as hereinbefore particularly described and as shown in the accompanying drawings.

4. A filter unit according to claim 1 or 2, in which said tongue has an axial slit therein.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1972.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1275651 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

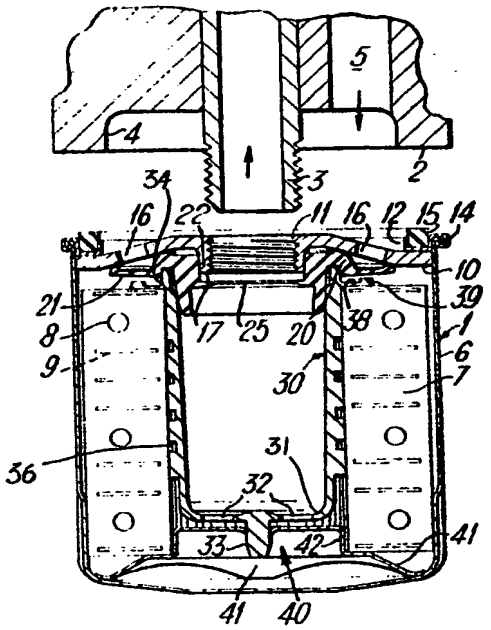

Fig. 1.

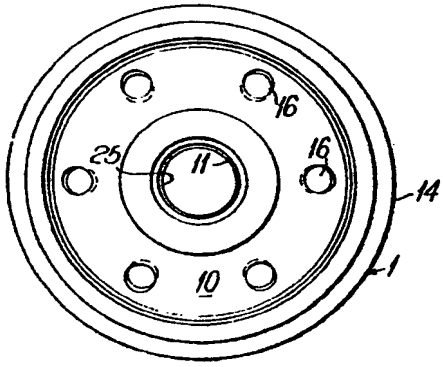

Fig. 2.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

Fig. 3.

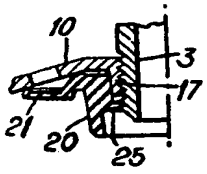

Fig. 4.